

Nalco Docket No.: 7726-NES

Customer No. 000049459

CLAIMS

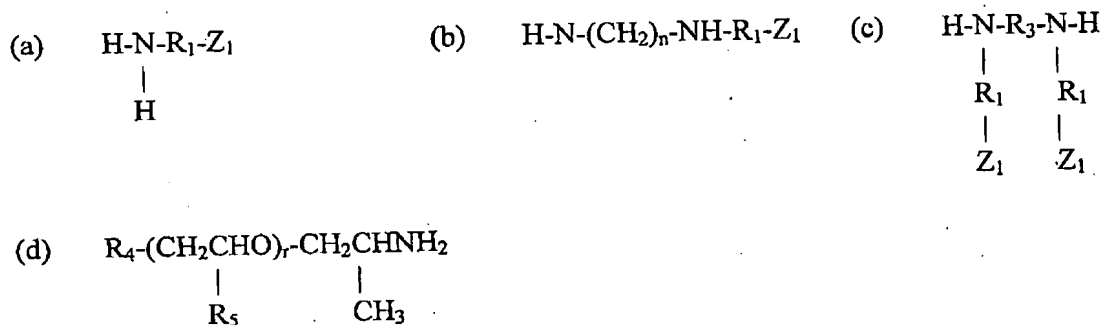
1. (currently amended) A method of modifying the permeability to water of a subterranean formation comprising injecting into the subterranean formation an aqueous composition comprising from about 0.005 percent to about 2 percent, by weight, of a water-soluble alkylene oxide branched polyhydroxyetheramine or a salt thereof, wherein the alkylene oxide branched polyhydroxyetheramine is prepared by reacting a diepoxide selected from the group consisting of diglycidyl ethers of polyhydric phenols with one or more alkylene oxide functionalized amines and one or more amines having two reactive hydrogen atoms and optionally reacting the resulting polyhydroxyetheramine with an acid or alkylating agent of formula $R_{14}X$ where R_{14} is C_1 - C_4 alkyl and X is halogen, sulfate or sulfonyl to form the salt.

2-3. (canceled)

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4. (original) The method of claim 1 wherein the alkylene oxide functionalized amine is selected from the group consisting of amines of formula (a)-(d)



wherein

R₁ is independently selected at each occurrence from a group of formula (-CH₂-CH₂-O)_p and a group of formula (-CH₂-CH(CH₃)-O)_q or a mixture thereof;

R₃ is C₂-C₂₀ alkylene optionally substituted with alkylamido, hydroxy, alkoxy, halo, cyano, aryloxy, alkylcarbonyl or arylcarbonyl;

R₄ is alkoxy;

R₅ is H or -CH₃;

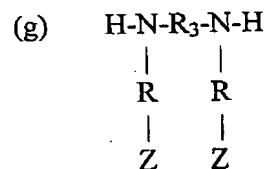
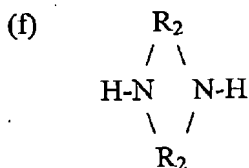
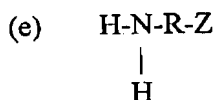
Z₁ is independently selected at each occurrence from hydrogen, C₁-C₇ alkyl and acyl; and

n, p, q and r are independently integers of 1 to about 45.

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5. (original) The method of claim 1 wherein the amine having two reactive hydrogen atoms is selected from the group consisting of amines of formula (e)-(g)



wherein

R is C₂-C₃₀ alkylene, optionally substituted with one or more hydroxy or hydroxyalkyl groups;

R₂ is C₂-C₁₀ alkylene, optionally substituted with alkylamido, hydroxy, alkoxy, cyano, dialkylamine, aryloxy, alkylcarbonyl or arylcarbonyl;

R₃ is C₂-C₂₀ alkylene optionally substituted with alkylamido, hydroxy, alkoxy, halo, cyano, aryloxy, alkylcarbonyl or arylcarbonyl; and

Z is hydrogen, alkylamido, hydroxy, dialkylamine, alkoxy, aryloxy, cyano, alkylcarbonyl, or arylcarbonyl;

6. (original) The method of claim 5 wherein R is methylene or ethylene; R₂ is ethylene; R₃ is C₂-C₂₀ alkylene optionally substituted with alkylamido, dialkylamino, hydroxy or alkoxy; and Z is alkylamido, dialkylamino, hydroxy or alkoxy.

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7. (original) The method of claim 5 wherein the amine having 2 reactive hydrogen atoms is selected from the group consisting of methylamine; ethylamine; propylamine; butylamine; sec-butylamine; isobutylamine; 3,3-dimethylbutylamine; hexylamine; benzylamine; 2-amino-1-butanol; 4-amino-1-butanol; 2-amino-2-methyl-1-propanol; 6-amino-1-hexanol; ethanolamine; propanolamine; tris(hydroxymethyl)aminomethane; 1-amino-1-deoxy-D-sorbitol; 3-amino-1,2-propanediol; 2-amino-2-methyl-1,3-propanediol; 2-amino-2-ethyl-1,3-propanediol; 3-(dimethylamino)propylamine; *N,N*-dimethylethylenediamine; *N,N*-diethylethylenediamine; 1-(2-aminoethyl)piperidine; 4-(2-aminoethyl)morpholine; 2-(2-aminoethyl)-1-methylpyrrolidine; 1-(2-aminoethyl)pyrrolidine; 2-(2-aminoethyl)pyridine; 2-(2-aminoethoxy)ethanol; 2-(2-aminoethylamino)ethanol; piperazine, 2-methylpiperazine, 2,6-dimethylpiperazine; 2-(methylamido)piperazine; *N,N'*-bis(2-hydroxyethyl)ethylenediamine, *N,N'*-dimethylethylenediamine, *N,N'*-dimethyl-1,4-phenylenediamine and *N,N'*-dimethyl-1,6-hexanediamine.

8. (canceled)

9. (currently amended) The method of claim 3 1 wherein the diglycidyl ether of a polyhydric phenol is selected from diglycidyl ethers of resorcinol; catechol; hydroquinone; bisphenol A; bisphenol F; bisphenol E; bisphenol K; 4,4'-dihydroxydiphenyl sulfide; bisphenol S; 4,4'-thiodiphenol; 2,6-dihydroxynaphthalene; 1,4'-dihydroxynaphthalene; 9,9-bis(4-hydroxyphenyl)fluorene; dihydroxy dinitrofluorenylidene; diphenylene; 2,2-bis(4-hydroxyphenyl)-acetamide; 2,2-bis(4-hydroxyphenyl)ethanol; 2,2-bis(4-hydroxyphenyl)-*N*-methylacetamide; 2,2-bis(4-hydroxyphenyl)-*N,N*-dimethylacetamide; 3,5-dihydroxyphenyl-acetamide; 2,4-dihydroxyphenyl-*N*-(hydroxyethyl)-acetamide; 2,2-bis(4-hydroxyphenyl) methane; 2,6,2',6'-tetrabromo-*p,p'*-bisphenol A; 2,6,2',6'-tetramethyl-3,5,3'-tribromo-*p,p'*-biphenol; 2,6,2',6'-tetramethyl-3,5,3'5'-tetrabromo-*p,p'*-biphenol; tetramethylbiphenol; 4,4'-dihydroxydiphenylethylmethane; 3,3'-dihydroxydiphenyldiethylmethane; 3,4'-dihydroxydiphenylmethylpropylmethane; 4,4'-dihydroxydiphenyloxide; and 4,4'-dihydroxydiphenylcyanomethane.

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10. (currently amended) The method of claim 3 1 wherein the diglycidyl ether of a polyhydric phenol is selected from the diglycidyl ethers of bisphenol A, 4,4'-sulfonyldiphenol, 4,4'-oxydiphenol, 4,4'-dihydroxybenzophenone, 9,9-bis(4-hydroxyphenyl)fluorene and bisphenol F.

11. (currently amended) The method of claim 3 1 wherein the diglycidyl ether of a polyhydric phenol is the diglycidyl ether of bisphenol A.

12-15. (canceled)

16. (original) The method of claim 1 wherein the water-soluble alkylene oxide branched polyhydroxyetheramine comprises secondary amine, tertiary amine or ditertiary amine end groups.

17. (currently amended) The method of claim 16 wherein the water-soluble alkylene oxide branched polyhydroxyetheramine comprising secondary amine, tertiary amine or ditertiary amine end groups is prepared by reacting a the diepoxide selected from the group consisting of diglycidyl ethers of polyhydric phenols with one or more alkylene oxide functionalized amines and one or more amines having two reactive hydrogen atoms to form the water-soluble alkylene oxide branched polyhydroxyetheramine and then reacting the water-soluble alkylene oxide branched polyhydroxyetheramine with one or more amines having one or two reactive hydrogen atoms.

18. (currently amended) The method of claim 16 wherein the water-soluble alkylene oxide branched polyhydroxyetheramine comprising secondary amine, tertiary amine or ditertiary amine end groups is prepared by reacting a the diepoxide selected from the group consisting of diglycidyl ethers of polyhydric phenols with one or more alkylene oxide functionalized amines and one or more amines having two reactive hydrogen atoms and an amine having 3 or more reactive hydrogen atoms to form the water-soluble alkylene oxide branched polyhydroxyetheramine and then reacting the water-soluble alkylene oxide branched polyhydroxyetheramine with one or more amines having one or two reactive hydrogen atoms.

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19. (currently amended) The method of claim 1 wherein the water-soluble alkylene oxide branched polyhydroxyetheramine is prepared by reacting a mixture of the diepoxide selected from the group consisting of diglycidyl ethers of polyhydric phenols and one or more aliphatic or aromatic triepoxides with one or more alkylene oxide functionalized amines, one or more amines having two reactive hydrogen atoms to impart cross linking.
20. (currently amended) The method of claim 1 wherein the water-soluble alkylene oxide branched polyhydroxyetheramine salt is prepared by reacting a mixture of the diepoxide selected from the group consisting of diglycidyl ethers of polyhydric phenols and one or more aliphatic or aromatic triepoxides, one or more alkylene oxide functionalized amines, one or more amines having two reactive hydrogen atoms to impart cross linking and then an acid or alkylating agent.
21. (original) The method of claim 1 wherein the aqueous composition further comprises about 1 to about 10 weight percent of one or more clay stabilization salts.
22. (original) The method of claim 21 wherein the clay stabilization salts are selected from KCl, NaCl, NaBr, sodium acetate and NH_4Cl .
23. (currently amended) An aqueous composition comprising from about 0.005 percent to about 2 percent, by weight, of a water-soluble alkylene oxide branched polyhydroxyetheramine or a salt thereof and about 0.005 to about 2 percent by weight of one or more solubilizing agents, wherein the alkylene oxide branched polyhydroxyetheramine is prepared by reacting a diepoxide selected from the group consisting of diglycidyl ethers of polyhydric phenols and optionally one or more aliphatic or aromatic triepoxides with one or more alkylene oxide functionalized amines and one or more amines having two reactive hydrogen atoms and optionally reacting the resulting polyhydroxyethermaine with an acid or alkylating agent of formula R_{14}X where R_{14} is $\text{C}_1\text{-C}_4$ alkyl and X is halogen, sulfate or sulfonyl to form the salt.

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24. (original) The aqueous composition of claim 23 wherein the solubilizing agent is selected from isopropanol, butanol, 1,2-propylene glycol, ethylene glycol, hexylene glycol, *N,N*-dimethylformamide, *N,N*-dimethylacetamide, ethylene glycol butyl ether, diethylene glycol methyl ether, dipropylene glycol methyl ether, di(propylene glycol) methyl ether, propylene glycol phenyl ether and propylene glycol methyl ether.
25. (original) The aqueous composition of claim 23 further comprising about 1 to about 2 weight percent of one or more clay stabilization salts.
- 26-28. (canceled)
29. (currently amended) A water-soluble alkylene oxide branched polyhydroxyetheramine salt prepared by reacting a diepoxide selected from the group consisting of diglycidyl ethers of polyhydric phenols with one or more alkylene oxide functionalized amine and one or more amines having 2 reactive hydrogen atoms and then reacting the resulting polyhydroxyetheramine with an acid or alkylating agent of formula $R_{14}X$ where R_{14} is C_1 - C_4 alkyl and X is halogen, sulfate or sulfonyl.
30. (original) The water-soluble alkylene oxide branched polyhydroxyetheramine salt of claim 29 wherein the alkylating agent is methyl chloride or dimethyl sulfate.
31. (currently amended) A water-soluble alkylene oxide branched polyhydroxyetheramine salt comprising secondary amine, tertiary amine or ditertiary amine end groups prepared by reacting a diepoxide selected from the group consisting of diglycidyl ethers of polyhydric phenols with one or more alkylene oxide functionalized amine and one or more amines having 2 reactive hydrogen atoms and then reacting the resulting polyhydroxyetheramine with one or more amines having one or two reactive hydrogen atoms followed by an acid or alkylating agent of formula $R_{14}X$ where R_{14} is C_1 - C_4 alkyl and X is halogen, sulfate or sulfonyl.

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32. (currently amended) A water-soluble alkylene oxide branched polyhydroxyetheramine salt comprising secondary amine, tertiary amine or ditertiary amine end groups prepared by reacting a diepoxide selected from the group consisting of diglycidyl ethers of polyhydric phenols with one or more alkylene oxide functionalized amine, one or more amines having 2 reactive hydrogen atoms and an amine having 3 or more reactive hydrogen atoms and then reacting the resulting polyhydroxyetheramine with one or more amines having one or two reactive hydrogen atoms followed by an acid or alkylating agent of formula $R_{14}X$ where R_{14} is C_1 - C_4 alkyl and X is halogen, sulfate or sulfonyl.